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**Productivity in the central government sector in Finland –  
The case of the Ministry of Transport and Communications 2000–2005**

Jani HEIKKINEN, Statistics Finland  
Mira LEHMUSKOSKI, Statistics Finland

For additional information, please contact:

Author name(s): Jani HEIKKINEN / Mira LEHMUSKOSKI  
Author address(es): FI-00022 STATISTICS FINLAND  
Author E-mail(s): [jani.heikkinen@stat.fi](mailto:jani.heikkinen@stat.fi) / [mira.lehmuskoski@stat.fi](mailto:mira.lehmuskoski@stat.fi)  
Author fax(es): +358 9 1734 3429  
Author telephone(s): +358 9 1734 3339/ +358 9 1734 3317

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**CONTENT:**

<b>PRODUCTIVITY IN THE CENTRAL GOVERNMENT SECTOR IN FINLAND – THE CASE OF THE MINISTRY OF TRANSPORT AND COMMUNICATIONS 2000–2005.....</b>	<b>3</b>
1. INTRODUCTION.....	3
1.1 <i>History</i> .....	3
1.2 <i>Description of the statistics</i> .....	4
1.3 <i>Concepts and definitions</i> .....	5
1.4 <i>Uses and limitations of data on the productivity of central government</i> .....	6
1.5 <i>Notes on volume measure development</i> .....	7
2. CASE STUDY: MEASURING PRODUCTIVITY OF THE ADMINISTRATIVE SECTOR OF THE MINISTRY OF TRANSPORT AND COMMUNICATIONS .....	10
2.1 <i>How the project was carried out in practice</i> .....	10
2.2 <i>Data sources, methods and productivity indices for the agencies of the administrative sector of the Ministry of Transport and Communications</i> .....	11
2.2.1 Finnish Road Administration .....	11
2.2.2 Finnish Rail Administration .....	11
2.2.3 Finnish Maritime Administration .....	13
2.2.4 Finnish Communications Regulatory Authority.....	14
2.2.5 Finnish Institute of Marine Research .....	15
2.2.6 Finnish Meteorological Institute .....	16
2.2.7 Finnish Vehicle Administration .....	17
2.2.8 Ministry of Transport and Communications .....	18
2.3 <i>Labour and total input</i> .....	19
2.4 <i>Results</i> .....	19
3. CONCLUSIONS AND DEVELOPMENT NEEDS FOR PRODUCTIVITY INDICATORS .....	23
ACKNOWLEDGEMENTS.....	24
REFERENCES .....	25

# *Productivity in the central government sector in Finland – The case of the Ministry of Transport and Communications 2000–2005*

This paper first describes briefly the history of the statistics on the productivity of the central government compiled at Statistics Finland. After this, it describes the used basic concepts, definitions and methods. This is followed by a presentation of a case study made in the administrative sector of the Ministry of Transport and Communications and the results from this study. Development needs and future work in this area are discussed at the end of the paper.

## *1. Introduction*

### *1.1 History*

Statistics Finland has compiled indicators for productivity in the public sector since 1995. First, there was a project in which the aim was to develop statistics on the productivity of the public sector and introduce productivity measures for public services and, basing on these, form a systematic and consistent method for monitoring the productivity of the public sector and for compiling statistics on it. Put more precisely, the aim was to develop a measurement and monitoring system for the government sector's production and productivity by using the index theory and the output indicator method.

To achieve the aim, the project

- Collected data on the output and input of central government activities and evaluated the applicability of these – as well as that of already existing data – to the measurement of non-market output and productivity
- Collected data on the measurement and on the change of quality in the central government (this was done in 1996 and the results indicated that at that time there were no existing quality data on government agencies by which the quantities of output could have been adjusted)
- Evaluated methods for the measuring of productivity (use of different index formulas, adoption of the Törnqvist index)
- Applied a productivity measurement method based on comparing pairs of years
- Completed experimental calculations on productivity changes in the central and local government sectors.

The data analyses and experimental calculations carried out within the project proved that a basis existed for the establishment of systematic and comprehensive statistics on the productivity of public activities. Basic data for the measurement of productivity were already available, although they still needed further precision and expansion.

Statistics on the productivity of non-market public services have been produced regularly since the beginning of 2001. Statistics Finland produces data on the output and productivity of the central and local governments annually.

At the beginning of 2005, Statistics Finland launched a development project where the aim is to compile productivity indicators not only for the central government at the aggregate level but also separately at the levels of various administrative sectors (under the supervision of different ministries). The reasons for embarking on this development project were increased national interest in the measurement of public productivity due to the performance management programmes introduced in

the central government, the emerged need for different performance indicators for all government units, the recently adopted volume measures in Finnish national accounts (NA) and, of course, current international interest in the expansion of volume measures to a wide range of public services. Statistics Finland has, therefore, seen notable benefits to its customers from the introduction of volume measures for the public sector.

The development project is a four-year programme in which each ministry and every agency under it will be studied individually. In this process the activities of each agency will be studied carefully to check that the chosen output measures correspond with the public services that agency produces. If necessary, the output measures will be redefined. The aim of the project is to devise a separate productivity measurement calculations for every administrative sector of the central government and to improve the overall quality of the statistics on the productivity of the central government.

## *1.2 Description of the statistics*

The statistics on central government's productivity that Statistics Finland publishes describe volume changes in the output, labour input and total input of state agencies and institutions, and changes in the work and total productivity calculated from them. The data are published at the total level and at the level of administrative sectors. The scope of the statistics does not extend to unincorporated state enterprises, state-owned companies, funds or state-subsidised associations.

The statistics contain micro data about changes in the total productivity and labour productivity of central government agencies and about changes in their output, labour input and costs from 1995 onwards. The statistics are compiled annually from data on the units for which reliable and comparable data are available for successive years. Data by administrative sector are published for the administrative sectors from which a sufficient amount of information is available, including the individual and collective services produced by central government units.

The government agencies and institutions classify their own output categories. The data on expenditure by administrative sector categories are received from the State Treasury's accounting system. These data are also used as the source data in compiling production accounts for the central government in national accounts.

The main problem in the measurement of the productivity of public services is defining and measuring of final output. Therefore, a large part of the work to develop a method for measuring productivity has focused on questions relating to the defining of output and output indicators.

In order to measure output correctly and properly, the output indicators selected for the statistics on the central government's productivity must satisfy the following criteria:

- They cover all the services produced by a producer for external users, and only those
- They relate to the output of each service and definitely not to inputs, or to outcomes
- They take quality changes into account, e.g. by recognising new products
- They are weighted by the costs of each service in a recent base year
- They are defined in as much detail as possible
- They are consistent over time, meaning that product groups should measure the same output in each compared year.

Two of these criteria need to be briefly discussed here – the definition of final output and quality adjustment. The main question is what final output actually is. The services taken into account as output should be precise final products by nature. Output should be distinguished from outcome and from the measures relating to activities. Outcome is the (final) result from activity, whereas output is that which is produced.

Sometimes the identification of final products may be difficult and, in the absence of real output indicators, substitute (proxy) measures have to be used for output. This is also the case in some agencies and activities in Finland.

Defining and measuring the output of collective services has been considered as an especially difficult task. Maybe one reason for this is that the impacts of the services on individuals are not clearly definable. The point of departure in defining the output of collective services should be the production aspect. The definitions of final products can be derived from the tasks and activities with which organisations accomplish the functions of their activities and try to achieve the goals assigned for those activities.

The data on outputs and inputs are collected from all government agencies and institutions with a web-based electronic form. The survey covers 100 per cent of government units and the response rate has been over 70 per cent in the past few years. The non-response rate of 30 per cent comprises both real non-response units and response units with poor output indicators.

The data on changes in the central government's labour and total productivity are released annually in June on Statistics Finland's website at: [http://stat.fi/til/vatt/index\\_en.html](http://stat.fi/til/vatt/index_en.html).

Statistics Finland also compiles productivity statistics on the education, health and social work of the local government. These volume measures are fully adopted into Finnish national accounts and the published productivity statistics ([http://stat.fi/til/kktu/index\\_en.html](http://stat.fi/til/kktu/index_en.html)) are compiled from the national accounts data. National accounts also include volume measures for social security funds. These volume measures are compiled for NA by the same team that is responsible for the productivity statistics.

In Finland, health, educational and social services are mainly produced by the local government, but some central government institutions also produce these services. The volume measures for universities, a couple of small schools and for a few social service institutions operated by the central government are calculated separately for NA, even though the units and volume indicators are the same as in the statistics on the central government's productivity. The NA indicators are also compiled by the team responsible for the productivity statistics, but there are, nevertheless, some inconsistencies in the compilation due to differences in the data collection systems.

The data and results concerning the administrative sector of the Ministry of Transport and Communications presented in this paper make up a part of the public sector productivity statistics of Statistics Finland.

### *1.3 Concepts and definitions*

Changes in output, the volume indicator of output, describes weighted changes in the outputs of the agencies in question. The output indicators are weighted either by their share of costs, income or working time. In practice, the final products defined for an agency have been weighted together either by their cost share, income share or working time share so that volume changes in total output can be followed up at the level of different final products.

Changes in labour input, the volume indicator of labour input, describes changes in the quantity of labour input (measured in working days, worked hours or numbers of staff-years).

Changes in total input, the volume indicator of total input, describes deflated (with an index of the administrative sector in question) changes in costs. Total input consists of expenditure on materials and supplies, goods, personnel expenses, rents, purchased services, other expenses, production for own use, internal expenses, increase(-) or decrease(+) in stocks of finished goods and depreciations (which represent capital consumption). Depreciations deviating from plans are excluded from total costs.

The effect of inflation is eliminated from costs by deflation. Statistics Finland compiles a separate cost index for personnel costs, depreciation and other expenses for each administrative sector. The personnel costs, depreciation and other costs are deflated with a specific cost index of their own based on the price index of public expenditure ([http://stat.fi/til/jmhi/index\\_en.html](http://stat.fi/til/jmhi/index_en.html)).

Changes in work productivity: the volume indicator of output is divided by the volume indicator of labour input.

Changes in total productivity: the volume indicator of output is divided by the volume indicator of total input.

The Divisia-Törnqvist index calculated from the output and input indicators for output and input is:

$$\frac{Q_t}{Q_{t-1}} = \exp\left(\sum_{i=1}^n \bar{w}_{i,t} \ln \frac{q_{i,t}}{q_{i,t-1}}\right), \text{ where}$$

$$\frac{Q_t}{Q_{t-1}} = \text{the ratio of output in the current year } (t) \text{ to output in the previous year } (t-1)$$

n = number of products

$\ln \frac{q_{i,t}}{q_{i,t-1}}$  = the natural logarithm of the ratio of the quantity of product *i* in the current year *t* to the quantity in the previous year *t-1*

$\bar{w}_{i,t}$  = the average share weight for product *i*

$$\bar{w}_{i,t} = \frac{w_{i,t} + w_{i,t-1}}{2}, \left(\sum_{i=1}^n \bar{w}_{i,t} = 1\right)$$

The Törnqvist index is used to aggregate the output data of each unit and to create its output index. Likewise, it is used for the aggregation of output and input data for the total indices both at the level of an administrative sector and at the overall central government level. It is weighted with the cost and labour input data of each unit.

## *1.4 Uses and limitations of data on the productivity of central government*

Each unit having responded to the questionnaire gets feedback about their answers. This consists of indices of output, labour input, total input, labour productivity and total productivity. The idea is that the unit itself can use this feedback to monitor changes in its own productivity between the compared years. This information on productivity can be used to evaluate the effectiveness of its operations aimed toward improvement of productivity. Such operations are e.g. adoption of automation, new IT systems or structural arrangements in the agency in question.

The statistics on central government's productivity are published at the levels of administrative sectors and at the aggregate level of the central government. These statistics reveal changes in productivity and they provide an analysing tool for ministries to decide how and what is produced by the central government and by whom. Examples of situations where productivity changes need to be tracked are negative returns to scale when adding production, outsourcing parts of the government's production chain and in cases of mergers between government units.

Important guidance to the users in different managerial positions in the central government is provided by the "Handbook on Performance Management" (published by the Ministry of Finance) which points

out the importance of developing different indicators for diverse aspects of public production for monitoring purposes at the level of government units. According to the handbook, the performance indicators required are e.g. indicators showing the volume of certain outputs, economy and productivity, quality and internal functionality (output quality separated from customer or staff satisfaction), effectiveness and social impact. One can see from the above list that there are several links between the productivity statistics and the indicators required for the government units.

The aim of this measurement is to make an index from changes in the output/input volume ratio (as a matter of fact, the supply and use ratio) and for this reason it does not take into account changes in the marginal benefits of public production. Thus, outcome aspects are excluded from these productivity measures.

Changes in quality are mainly taken into account in output volume indicators by dividing services/products into quality categories. Additional information about special characteristics of services, e.g. capacity, weighted quality aspects, is also taken into consideration. New products are included by summarising them along with old product groups by using quality coefficient based on unit costs. After that, new products are introduced as a new quality category.

This is based on the assumption that all government consumption is voluntarily paid by taxpayers (non-market production part of total government production), production decisions are made rationally and all government production is consumed (is always true in NA). Thus, the government can produce output that is not necessarily wanted by individuals, but which they are forced to use, such as services related to imprisonment, public order and law enforcement. Moreover, the government can make wrong, short-handed or unnecessary production decisions very productively. These are factors that are visible when the economy's total productivity is under consideration.

### *1.5. Notes on volume measure development*

Atkinson's review proposes that qualitative changes and their measurement play a crucial role in the measurement of the volume of non-market services. If only quantitative indicators are used, some quality changes go easily unnoticed as volume changes, although some structural changes - certain portions of qualitative changes in services - can be measured as change in volume (cost-weighted index) if the services are classified in enough detail. For those cases where quality change cannot be captured with detailed classification of outputs one could measure the outcomes as quality indicator (degrees of success) of public sector activities. (Atkinson 2005)

The measurement of effects/outcomes is approaching the measurement of effectiveness instead of output. Great caution should be taken in combining these two concepts. Measurement of the effect of an activity and measurement of the output of an activity should be kept separate rather than combined, because outcome indicators are often influenced by factors that have very little to do with the planned public production results. For instance, health is not an outcome of an individual activity (or even a series of activities) but, quite the opposite, the health of an individual is a complex combination of a variety of factors. Health care services can play a minor role in the general health of the population. Education, private production of goods and services and even radiation from outer space, such as UV light, can contribute significantly to the development of general health.

When assessing outcomes it should be noted that only a portion of the changes observed in them arise from actions taken by the producers of non-market services. There is also the feature that outcomes or effects flow from one economy to another. The Chernobyl disaster still has notable outcome effects in Finland despite Finnish government services. Examples of this kind are discussed in SNA93 chapters 1.76.-1.81.

There is also a danger that only positive outcomes are taken into account when outcome quality adjustments are being measured. Public production can also have negative effects, such as restrictions

on certain operations of economic actors. Conservation of nature is a complex example, where government produces laws, decisions and surveillance output but, in terms of the total economy, it is not clear whether production possibilities are better or worse and what the timeframe should be for the measuring of outcome effects (short-term vs. long-term).

Social welfare and social outcome are both outside national accounts frame of volume measures and so there is a severe risk of double-accounting public output volume in national accounts if increased productivity is mixed with welfare or utility-based output corrections. The question always remains of: “How much of the change in the outcome of a public service is measured, knowing that all the desired outcome effects are not achieved by the actions of public producers?” All in all, the volume indicator of products and services should be the same regardless of the service provider and source of funding (when the features of output are same). If these effects have to be taken account in public services what about market production, should similar outcome based quality corrections be included there?

Another aspect relating to outcome corrections rises from SNA93 where at 16.10 it is stated that “The aggregation of the values of different goods and services is justified by the fact that, in a market system, the relative prices of different goods and services should reflect both their relative costs of production and their relative utilities to purchasers, whether the latter intend to use them for production or consumption. Relative costs and relative utilities influence the rates at which sellers and buyers are prepared to exchange goods and services on markets.” This SNA Section leads us to assume that only direct market price formation gives the right weights for the different products produced. Furthermore, there is an assumption of fully competitive markets where totally right price ratios can be found.

On the other hand, there are certain theoretical characteristics that prevail when the assumption of fully competitive markets holds true. No extra profits, no market power for single or small group of producers or buyers, are examples of such features, but they are not rational when evaluated against real economies. It seems that there are no totally right ways for aggregating market production through price statistics, and observed prices are good but proxy measures for valuation.

It is commonly stated that public production gets wrong weights if only the costs of production are taken into account to represent relative prices. This line of thought basis on the assumption of priceless public production.

However, some market features are adopted in the formation of costs in the public sector. The input needed by the public sector is purchased from the market. For instance, the labour market could reflect the social benefits of certain public production. Salaries differ between physicians and librarians, but both require university level education. This difference relates to the marginal utility of the public products that the labour force produces. It is questionable whether cost would be the totally wrong aggregation basis between public products.

There is also a problem in examining the volume at market production through price indices. New products tend to have the problem where part of the actual volume change is drifted to the price index. In this situation the volume change of market production is also too low.

However, a share of public production is aggregated with the production of other producing sectors. Again, the right aggregation method should be derived from relative prices on the free market. There seems to be no right way of reasoning whether the value of a unit of public production might be higher or lower when compared to private production. In cases where there is similar production in different sectors there is evidence of both ratios (road maintenance services in case of this paper). So the volume summed up with total costs is not the truth, but we do not know to which side of the truth it errs.

Other applied example is measurement of the output of fire fighting services. There is discussion about the right weight for the output where the value of the protected property is part of the output. This is a

tricky question because we cannot be sure whether the “price” of the fire fighting services would be higher or lower if they were produced by a competitive market. This movement relation between fire fighting costs and the value of that which is being protected could be seen mainly as changes in relative prices, not undetected volume weight.

One acceptable way for introducing outcome-based quality correction could be to do corrections after fully balanced NA. After that to take total final consumption product by product, monitor changes in the products and set these changes aside with outcome changes. Then exclude non-domestic outcome effects and distribute rest of the outcome effects to products and services of final consumption.

After this compilation we can assume that because of accurate price information the volume change of market production takes the outcome effects fully into account and only quality correction needs to be done in public products with distributed shares. This line of thought seems fairly swift when considering the annual compiling of statistical data and its assumptions are in many cases untrue.

The measurement method introduced in this paper tracks movements in the production possibility frontiers caused by changes in a public producer’s productivity and isolates all other decision factors to be measured independently. The reason for the exclusion of outcome effects from these statistics is that an increase in public production may have productivity outcomes for other producers. Extra public output extension e.g. better transport possibilities and secured operational environment, is used by other producers (no other inputs increase). This change in production is measured through national accounts.

So why worry if there is the same volume problem in the private sector? Could we not compare private and public production sufficiently well and exclude the outcome part fully from the NA frame?

## *2. Case study: Measuring productivity of the administrative sector of the Ministry of Transport and Communications*

### *2.1. How the project was carried out in practice*

This paper introduces a project in which the aim was to define output indicators for the agencies within the administrative sector of the Ministry of Transport and Communications (MINTC) so that Statistics Finland could use the same definitions of output for its statistics on the productivity of the public sector. The originally defined aim of the project was to be able to cover one hundred per cent of the administrative sector. In other words, the idea was that the project would be able to develop output indicators for all the agencies.

Participants in the project:

- MINTC; the leader of the project and the co-ordinator in the defining of outputs
- Statistics Finland; responsible for the general development of output indicators. Statistics Finland's task was to ensure that the definitions were comparable between agencies and that they were in line with the productivity indicators for the general government sector in general.
- The agencies in the administrative sector of the MINTC; the role of the agencies was to act as experts in their own agency and its activities. The agencies themselves were also responsible for producing the definitions and the data for the project.

Internal working groups were established at the agencies to produce the data and go through the principles against which the productivity of their organisations were to be measured.

There were four phases of the project: 1) Establishment of what kinds of indicators were already available from the organisations (e.g. from the book-keeping system), 2) Independent development of indicators, 3) Compilation of time series and 4) Conclusions from the project.

Output indicators for describing the productivity of the administrative sector of the MINTC have been established in close co-operation with the agencies that were responsible for the data production. It was essential to the relevance of the indicators that they had been compiled according to common principles. At the beginning of the project the agencies were divided into three subgroups according to their functions and responsibilities: 1) Scientific organisations, 2) Network agencies and 3) Other agencies. The subgroups met during the project to discuss the stages of the project and special topics that arose during the project. For example, the network agencies developed their own indicators in close collaboration to ensure that they would be as comparable as possible.

The timetable of the project was as follows: from January to August 2005, goals were set for the different participants and preliminary output indicators were defined (phases 1 and 2). From September to December 2005, preliminary time series of productivity indicators were compiled for the years 2000 - 2004 and the indicators were finalised (phases 3 and 4). The final report of the project was completed in February 2006.

The MINTC financed some bilateral consultations between Statistics Finland and the participating agencies. This was not necessary in all cases but specific questions and problems of the agencies concerned were discussed and solved during these consultations.

## 2.2 Data sources, methods and productivity indices for the agencies of the administrative sector of the Ministry of Transport and Communications

### 2.2.1 Finnish Road Administration

The output of the Finnish Road Administration is supply of road network capacity broken down by traffic performance class. For the compilation of the productivity index the road network is divided into 10 categories so that the standard of service within each category is assumed to be of the same quality (performance capacity). These categories exclude each other - for example, “Other main roads” excludes the main roads classified as “Motorways”, “Semi-motorways” and “Other dual carriageways”.

The quantity of an output unit is measured for each service category by multiplying the length of each unit by its typical performance capacity (vehicle/hour).

TABLE 1. Quantity of final product, traffic performance capacity and length of the unit.

<b>Output indicator</b>	<b>Output</b>	<b>Average capacity (vehicle/hour)</b>	<b>Length in kilometres, 2004</b>
Ferries	5	100	49
Ramps	2,052	2,200	933
Motorways	6,403	10,000	653
Semi-motorways	417	2,847	146
Other dual carriageways	2,313	6,700	345
Other main roads	29,882	2,470	12,197
Local roads	25,507	1,900	13,425
Connecting roads, paved	40,404	1,660	24,340
Connecting roads, gravel	27,062	1,000	27,062
Pedestrian and cycle paths	2,094	400	5,235

The capacities of the different kinds of roads are based on the HCM2000 (Highway Capacity Manual) method. Only minor changes take place yearly in the capacities of the different road types, depending on the length and capacity of new finished roads. The capacity of a road is improved by grade-separated intersections, widening of roads as well as by conversions to three-lane motorways (compared to the normal two-lane motorway). In reality, the capacity of roads is mostly affected by their traffic performance. When increased traffic causes grown congestion it, naturally, also reduces the theoretical capacity of the road. It is assumed that all major quality aspects are taken into consideration through adherence to the HCM2000. Increased safety of roads means greater theoretical capacity of roads. At ferry crossings, capacity is affected by the size of the ferry and operation without a schedule.

The length of the road network is defined by road region at the accuracy of one meter from the road register according to the situation on the last day of the year. Road investments are not normally finished until October or November. Depreciations are also recorded as per the situation at year end so the volume of assets also describes the same date.

### 2.2.2 Finnish Rail Administration

The Finnish Rail Administration (RHK) is responsible for making sure that railroad companies have a competitive network available to them. The final output of the RHK was defined basing on this principle. Its output is an operational railroad network, measured in rail kilometres. Its overall quality can be affected by a variety of factors. Among them, the most important ones are speed, mainly affecting passenger traffic, maximum axle weight, influencing freight traffic, and electrification and

standard of safety equipment, which have a bearing on both types of traffic. Besides the railroad network, traffic control and real estate management are also taken into account as outputs of the RHK and they are measured by the number of controlled rail kilometres and millions of gross cubic metres managed.

The output was divided into four groups according to quality. The categories for speed and maximum axle weight were: 1) Over 160km/h and 25 tonnes, 2) Over 140 km/h and 22.5 tonnes, 3) Over 100 km/h and 22.5 tonnes and 4) Under 100 km/h and under 22.5 tonnes. These classes describe best the state of the railway network. There are parts of the network that are only used for freight and in such cases the axle weight can be 25 tonnes but the speed does not exceed 160 km/h. However, as far as freight is concerned this describes best the existing quality, so the quality criteria chosen to depict the best quality is defined as “speed over 160 km/h and/or axle weight of 25 tonnes”.

These four main groups were then been divided into smaller output categories based on their electrification and safety equipment. This produced 16 different output combinations based on the quality of the network (for example, speed over 160 km/h or axle weight 25 tonnes, electrified and with safety equipment). In addition to these categories, large railway yards are monitored separately. The main factor affecting their quality is the presence of safety equipment.

When investments are made in a certain section of the railway system to improve its quality, this should be taken into account as a change in the volume of output - the section concerned should be moved from one quality level to another. Output will then diminish in one quality category and go up in another. All these quality categories of output are listed in Table 2.

TABLE 2. Output indicators and quality coefficients of Finnish Rail Administration.

<b>Output indicator</b>	<b>Quality coefficient</b>
Yards without safety equipment (km)	1.0
Yards with safety equipment (km)	2.5
>160 km/h or 25 t, electrified and with safety equipment (km)	3.2
>140 km/h and 22.5 t, electrified and with safety equipment (km)	2.7
>100 km/h and 22.5 t, electrified and with safety equipment (km)	2.2
<100 km/h or <22.5 t, electrified and with safety equipment (km)	1.8
>160 km/h or 25 t, electrified and no safety equipment (km)	2.7
>140 km/h and 22.5 t, electrified and no safety equipment (km)	2.2
>100 km/h and 22.5 t, electrified and no safety equipment (km)	1.8
<100 km/h or <22.5 t, electrified and no safety equipment (km)	1.4
>160 km/h or 25 t, non electrified and with safety equipment (km)	2.6
>140 km/h and 22.5 t, non electrified and with safety equipment (km)	2.1
>100 km/h and 22.5 t, non electrified and with safety equipment (km)	1.7
<100 km/h or <22.5 t, non electrified and with safety equipment (km)	1.3
>160 km/h or 25 t, non electrified and no safety equipment (km)	2.1
>140 km/h and 22.5 t, non electrified and no safety equipment (km)	1.7
>100 km/h and 22.5 t, non electrified and no safety equipment (km)	1.3
<100 km/h or <22.5 t, non electrified and no safety equipment (km)	1.0
Real estate management (millions of gross m <sup>3</sup> managed)	
Traffic control (rail kilometres controlled)	

Cost data are allocated to the different output categories basing on the quality coefficients defined for them. The coefficients in Table 2 have been defined with the help of the data on expenditure in Table 3, which have been compiled relative to their period of depreciation (for safety equipment 15 years, electrification 30 years and superstructure 30 years). In addition, information about maintenance and operating costs per meter of railway has been utilised (based on 2004 information) in defining the coefficient for each quality level. In future, these data on costs will have to be updated annually case by case.

**TABLE 3.** Costs applied in calculations of quality coefficients.

<b>Measure</b>	<b>Price</b>	<b>Unit</b>
Safety equipment in railway	90,000	€/railway kilometre
Safety equipment in railway yard	270,000	€/railway kilometre
Electrification	230,000	€/railway kilometre
Increasing speed/axle weight (<140 km/h and 22,5 t)	550,000	€/railway kilometre
Increasing speed/axle weight (>140 km/h and 22,5 t)	750,000	€/railway kilometre
Increasing speed/axle weight (>160 km/h and 25 t)	950,000	€/railway kilometre

### 2.2.3 Finnish Maritime Administration

The Finnish Maritime Administration (FMA) has several duties which means that there are several outputs to measure. To calculate the productivity index, its outputs were defined as shown in Table 4. For fairway maintenance, the classification describes roughly differences in service levels. The classification covers 100% of the duties so all expenditure of the FMA is taken into account. The results for the productivity indices will be shown at the level of the FMA even though they are formed through “partial productivity indices”.

**TABLE 4.** Outputs of Finnish Maritime Administration.

<b>Activity</b>	<b>Output indicator</b>
Maritime safety; state authority activities	constant, 1 unit
Maritime safety; inspections	inspections, auditing, surveys; number
Maritime safety; licensing authority	decisions, certificates; number
Fairway maintenance; coastal merchant shipping	fairway kilometres
Fairway maintenance; other coastal waterway transport	fairway kilometres
Fairway maintenance; inland waterways merchant shipping	fairway kilometres
Fairway maintenance; channels for inland waterway merchant shipping	hours open
Fairway maintenance; other inland waterway transport	fairway kilometres
Fairway maintenance; other inland waterway transport - channels	hours open
VTS (vessel traffic service) coastal	supervised kilometres
VTS inland waterways	supervised kilometres
Gofrep (Gulf of Finland reporting system)	constant 1 unit
Pilotage; state authority activities	number of granted/renewed licences
Island (archipelago) ferries	number of passengers
Icebreaking services; coastal	number of winter ports
Icebreaking services; inland waterways	assisted tons
Hydrographic surveying	weighted measurement km <sup>2</sup>
Charting services	renewal of charts of the sea areas, % increase of the figure
Distress and safety radio communications	number of messages
Outside duties	constant 1 unit
Statistics	number of statistics
Vessel register	registered ships
Production of buoys	produced buoys
Rental services	constant 1 unit
Oil spillage prevention measures	constant 1 unit

It is common to all operations of the FMA to stay fairly similar from one year to the next. A good example of this is the number of open winter ports. The definition of icebreaking services does not assume that quality differences between the years arise from the opening times of ports or numbers of assisted tonnage. The classification describes well the fact that in many cases the productivity of the FMA is dependent on external factors (harsh or mild winter).

There are still some areas needing further developed in the compilation of the productivity index for the FMA. Special consideration should be given to the definitions of outputs. Some revisions have been made concerning fairway maintenance kilometres, but these have been only technical in nature and not based on any real data on changes.

There should be certain quality corrections for icebreaking to allow for the characteristics of the broken fairways. The Finnish Maritime Administration can today maintain wider fairways through thicker ice than a couple of decades ago. This could be taken into account by measuring changes in winter fairway conditions, and weighting them by information from expenditure data.

It became clear during this project that the current cost control and operative systems of the FMA do not fully support the monitoring of output and productivity indices (especially what comes to hydrographic surveying). Work is currently going on to improve the cost control system and the aim is that in future it will better support development of the activities of the agency.

#### *2.2.4 Finnish Communications Regulatory Authority*

When defining outputs for the Finnish Communications Regulatory Authority (FICORA) the project used the results of an earlier project which focused on developing the agency's processes. During that project the core processes of the FICORA were identified and descriptions were drafted for them. Additionally, other clearly identifiable and measurable outputs were taken into account. Thus, a list of outputs could be drawn up to cover most of the services provided by the FICORA during the reviewed years of 2003 and 2004. In respect of total costs, the coverage in both years was more than 91%. The outputs of the FICORA are listed in Table 5.

**TABLE 5. Outputs of FICORA**

<b>Output indicator</b>
Decisions on Significant Market Power (SMP) on communications markets
Supervisory decisions on SMP
Recommendations, guidelines and opinions concerning cost accounting audits
Recommendations and guidelines concerning financial obligations
Supervisory decisions on telecommunication services
Supervisory decisions on media services
Supervisory decisions on postal services
Quality studies of media services
Quality studies of postal services
Undelivered postal items services
Supervision of the communications markets and statistics
Information about communications markets and services
Licences and telecommunication notifications
Number of Internet domain names controlled by FICORA <sup>1</sup>
Decisions concerning the application of the regulation on domain names
Inspection of telecommunications enterprises
Progress report on information security
CERT (Computer Emergency Response Team) warnings and guidelines
CERT customer cases
Technical regulations and guidelines on telecommunications networks
Supervisory decisions on telecommunications enterprises
Information about communications networks
Numbering decisions on the telecommunications networks
Registration or changes of the notification of telecommunications contracting
Opinions on the international standardisation of telecommunications
International decisions on radio frequencies
Collective frequencies for licence-exempt radio transmitters <sup>2</sup>
Frequencies for radio equipment subject to licence
Certificate of competence in radio communications
Registered examinations of radio communications
Surveillance of use of radio frequencies
Surveillance of sales of radio equipment
Information services of radio communications
Total number of months for which television fees were collected <sup>3</sup>
Actively acquired television fees

In the case of the FICORA, all the quality aspects are supposed to be reflected in the product grouping. New products are introduced as new classes and quality differentiation within a product group is random by nature, and does not impose changes in “average quality”.

### *2.2.5 Finnish Institute of Marine Research*

The output of the Finnish Institute of Marine Research (FIMR) was divided into six categories (Table 6) and research covers more than 60% of the activities of the institute. Together, these six categories cover 85% of the activities of the FIMR

<sup>1</sup> Domain names are valid for three years after which they have to be renewed. The number covers all valid domain names. The system of domain names requires constant updating and development and hence it is justified to take them all into account in productivity calculations.

<sup>2</sup> Collective frequencies for licence-exempt radio transmitters are frequencies in common use. A radio licence is not needed for the use or possession of radio transmitters which operate on these collective frequencies. The frequencies are mainly based on European or global decisions.

<sup>3</sup> Paid television fees have been converted into the number of months for which they were collected in order to make their durations comparable.

**TABLE 6. Outputs of Finnish Institute of Marine Research**

<b>Output indicator</b>
Research activities, publications (weighted)
Monitoring activities, trips
Ice service, as public authority
Ice service, subject to a fee
Wave and sea level information service, as public authority
Wave and sea level information service, subject to a fee

Publications are combined into one index figure by giving a different weight to each type of publication based on its quality and scope (for example internationally referred publications, doctoral theses, books, reports, publications in the FIMR series, and so on). For instance, an internationally referred publication gets a higher quality coefficient than a publication in the FIMR's own series. The coefficients are based on an evaluation of quality and needed inputs by type of publication and they are only used at the FIMR and are not directly usable in any other research institution.

Monitoring activity is based on internationally agreed duties to monitor conditions in the Baltic Sea, mainly accomplished with the research vessel Aranda, and these obligations cover most of the northern Baltic Sea. The effect from the monitoring activity on total productivity is quite constant over the years. There is a need to include a more precise quality element for the monitoring activity and in this sense the indicator needs further development. In 2004, the share of the monitoring activity of total costs was under 17%.

The main outputs of the ice service are ice charts and ice reports. Other outputs include various statements, forecasts and analyses of ice conditions in the Baltic Sea. The different outputs are weighted based on a scale for each product. Although the share of the ice service varies according to winter conditions, its production still represents only about five per cent of the total costs of the FIMR. There are separate outputs for activities as a public authority and for those subject to a fee.

Information about wave and sea levels is obtained for the database of physical oceanography with mareographs and wave buoys, for example. The information is distributed both as a free public service and subject to charge. For the purpose of describing outputs, weights have been allocated to the products and services. This is done through a complicated point system which is based on, for example, the number of parameters and frequency of measurement of certain phenomena.

### *2.2.6 Finnish Meteorological Institute*

The services of the Finnish Meteorological Institute (FMI) were divided into four categories. Research represents half of the service production. The output of the research activities is based on publication index points. The output of other services is divided into products financed from the state budget and products subject to a fee (i.e. either based on legal obligation or commercial activity).

**TABLE 7. Outputs of Finnish Meteorological Institute**

<b>Output indicator</b>
Research activities, publications (weighted)
Activities financed from state budget
Activities subject to a fee: based on legal obligation
Activities subject to a fee: commercial activity

The indicator for research is the weighted number of publications. Different publications have been weighted together by using quality and cost coefficients. The value of a coefficient varies according to how scientific a publication is, how widely it (publication series) is circulated or how extensive it is. Points are not allocated based on workload, other merits or periodically and routinely produced, even

if scientifically quite significant, publications (examples of this are climatological statistics or statements as an authority in accident situations).

The outputs of the FMI have been classified according to client groups. It is possible to allocate cost and quantity data to these client-based product groups. The volume of output can be derived from quantity information.

### 2.2.7 Finnish Vehicle Administration

It was possible to cover 94% of the outputs of the Finnish Vehicle Administration (AKE) for the years 2000-2004. In future, activities financed direct from the state budget and supervising of inspection operations will also be included in the outputs of the AKE and the coverage should be 100%.

The outputs of the AKE can be divide into four categories:

- Products subject to a fee
- Supervision of inspection activities based on law
- Activities financed from the state budget
- Administration of vehicle taxation (financed from the state budget)

TABLE 7. Outputs of Finnish Vehicle Administration

<b>Output indicator</b>
Type approval of vehicles
Technical vehicle statements
Trade of transportation accessories
Registration of vehicle mortgage
Vehicle registration activities
Driving licences
Driver examinations
Professional transportation services
Certificates
Training for technical inspections
Inspection licences
Document services
Oral theoretical examinations on health grounds
Preliminary rulings
Special licence plates
Certificates of trade plates
Exceptional permits for vehicle combinations registered outside of EEA
Information services
Collection of annual vehicle taxes
Decisions concerning automobile tax

There are no special quality measures used in the output indicators (Table 7) because the selected indicators represent established government services, e.g. type approvals. Quality improvements mostly take place within the production process and their results are not supposed to be visible to customers - they will receive the same service even where the internal process has changed. If a completely new service is introduced, a new output indicator also has to be created.

### 2.2.8 Ministry of Transport and Communications

The figures describing the productivity of the Ministry of Transport and Communications (MINTC) should be reviewed together with those for the rest of the administrative sector under its supervision. This point of view is based on the nature of the activity of the ministry itself. The activities of the MINTC can be compared with those of a company management in the corporate world. The management does not produce products but the productivity of the whole company reflects its productivity, in other words, the success of the management in running the whole company.

From the productivity perspective the ministry also has its own outputs, which have been taken into account when compiling productivity indices for the whole administrative sector. The core processes of the ministry are drafting of legal acts, performance management, and agreeing of performance targets and criteria. A working group having examined the cost allocation practices of ministries proposed that a common frame of the following structure should be used in all ministries:

- Strategies and monitoring of policy targets
- Performance management
- Preparation of a legislative proposals
- Tasks related to EU and to other international tasks
- Other tasks specific to a ministry
- Common tasks to the ministry

From the perspective of productivity measurement the above listing of processes is not satisfactory. Especially strategies and monitoring of policy targets, and performance management, do not produce any products which could be measured or any service to outside customers, but half of the available resources are assigned to these tasks. Without strategies there would be no output. These processes are not taken into account when indices on productivity are compiled.

Nevertheless, it is still possible to identify certain outputs in the activities of the MINTC which are produced to end users. In addition to the other outputs of the administrative sector a few outputs could be assigned to the Ministry itself:

**TABLE 8: Outputs of the Ministry of Transport and Communications**

<b>Output indicator</b>
Legal proposals of the government (number)
Regulations laid down (number)
Decrees on public charges (number)
EU legislation (legal proposals in process)
Granting of licences (number of decisions)
Studies (number)
International agreements (number)
Subsidies (number of decisions)
Parliamentary questions (number of answered questions)

Especially the titles describing legislative processes are not satisfactory, because the number of proposals does not tell anything about the coverage or quality of the proposals. The quality of the legal processes should be taken into account in a more proper way but it was decided that developing quality standards is not part of this project but that there should be a common classification for all legislative processes of the central government instead. All the ministries should follow common principles on how to estimate the coverage and quality of legal proposals.

The above classification only captures around 60% of all the outputs of the MINTC, and the remaining outputs are connected with management activities. Data on the outputs are only available for 2003 and 2004, but input data are widely available for 2000-2005.

The problem is that strategic planning of productive units forms a major part of the ministry's activity and total inputs but not of outputs. Such outputs should be included as inputs of the considered unit, but this is not the case. The bias the arrangement causes is not major because its weight at the level of the administrative sector is insignificant.

### 2.3 Labour and total input

For all agencies, the quantity of labour is based on their own book-keeping of working hours. The principles of this book-keeping are the same in all central government agencies. The reporting is done in working hours, days or years.

The method for processing labour input (and labour productivity) is similar to the private sector productivity measures derived from Finnish national accounts and is based on working hours (or working years). Adjustments are not made for structural changes in the labour force within a unit. However, when units are added up to the administrative sector and total government levels, developments in their labour force are weighted with the labour costs of the units concerned. Therefore, the units with high average labour costs receive a higher weight than could be measured direct from their working years.

The central government's book-keeping system is the main source for total input. The same source is also used when compiling national accounts. Because of the different production timetables (government productivity statistics are published earlier than the figures of annual NA), the data are compiled at a fairly aggregated level. However, differences in the changes of annual input are not significant between the practices.

### 2.4 Results

The data on the overall development of productivity have been compiled so that the agencies having responded are assumed to be representative of the development in general. The data on the development of outputs have been compiled basing on the following responses:

TABLE 9. Yearly data on agencies having provided data (x)

Unit	2000	2001	2002	2003	2004	2005
Finnish Vehicle Administration	x	x	x	x	x	x
Finnish Road Administration	x	x	x	x	x	x
Finnish Maritime Administration			x	x	x	x
Finnish Rail Administration				x	x	x
Finnish Communications Regulatory Authority				x	x	x
Finnish Meteorological Institute	x	x	x	x	x	x
Finnish Institute of Marine Research	x	x	x	x	x	x
The Ministry of Transport and Communications				x	x	x
Share of responded agencies of total costs, %	65	67	74	100	100	100

TABLE 10. Changes from preceding year in output, input and productivity indices, administrative sector of the Ministry of Transport and Communications and central government.

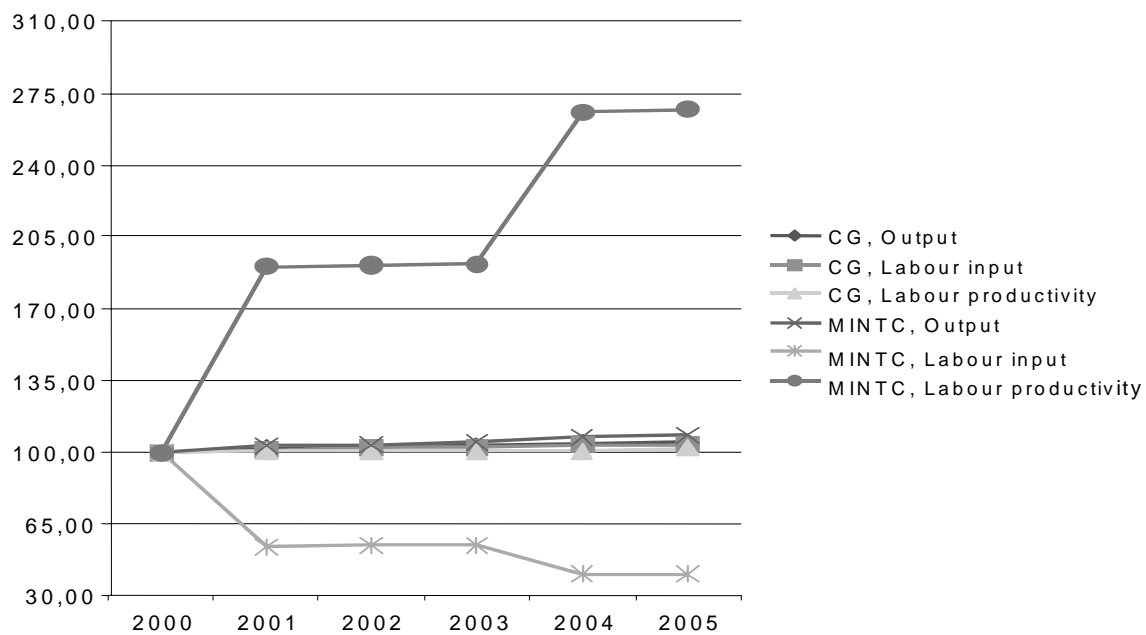
		2001	2002	2003	2004	2005
<b>Finnish Vehicle Administration</b>						
	Output	7.8	4.8	12.4	7.7	
	Labour input	8.2	8.0	8.8	8.0	
	Total input	-5.2	3.2	19.0	20.1	
	Labour productivity	-0.3	-3.0	3.3	-0.3	
	Total productivity	13.7	1.5	-5.6	-10.4	
<b>Finnish Road Administration</b>						
	Output	0.9	0.3	0.7	1.3	
	Labour input	-57.6	-0.4	0.3	-3.3	
	Total input	-1.2	-7.8	0.1	-4.0	
	Labour productivity	137.9	0.7	0.4	4.8	
	Total productivity	2.1	8.8	0.6	5.6	
<b>Finnish Maritime Administration</b>						
	Output			-4.3	2.9	
	Labour input	-2.5	-1.0	-0.2	-54.7	
	Total input	7.4	-4.4	6.7	-4.9	
	Labour productivity			-4.0	127.1	
	Total productivity			-10.3	8.3	
<b>Finnish Rail Administration</b>						
	Output				0.0	
	Labour input	3.0	10.1	14.9	9.3	
	Total input	4.3	5.9	1.2	4.1	
	Labour productivity				-8.5	
	Total productivity				-4.0	
<b>Finnish Communications Regulatory Authority</b>						
	Output				19.9	
	Labour input	5.8	6.8	0.9	3.0	
	Total input	6.3	0.8	-3.5	-0.3	
	Labour productivity				16.4	
	Total productivity				20.3	
<b>Finnish Meteorological Institute</b>						
	Output	45.4	3.4	9.0	14.1	
	Labour input	-1.9	0.0	-0.2	2.3	
	Total input	-2.2	-4.6	0.1	1.0	
	Labour productivity	48.2	3.4	9.3	11.5	
	Total productivity	48.7	8.4	9.0	12.9	
<b>Finnish Institute of Marine Research</b>						
	Output	5.1	24.9	5.9	-5.1	
	Labour input	7.5	8.8	-1.0	1.4	
	Total input	-5.1	7.9	-1.8	-0.6	
	Labour productivity	-2.3	14.7	7.0	-6.4	
	Total productivity	10.7	15.7	7.8	-4.6	
<b>Ministry of Transport and Communications</b>						
	Output				140.9	
	Labour input	-1.0	2.9	-0.5	0.7	
	Total input	-51.4	30.2	-21.9	19.2	
	Labour productivity				40.0	
	Total productivity				18.2	

<b>Administrative sector of Ministry of Transport and Communications</b>						
	Output	2.7	0.8	0.9	3.0	0.6
	Labour input	-46.1	0.7	0.3	-25.6	0.1
	Total input	-1.4	-6.7	1.6	-1.1	-1.6
	Labour productivity	90.6	0.1	0.6	38.4	0.5
	Total productivity	4.2	8.1	-0.6	4.2	2.2
<b>Central Government, total</b>						
	Output	1.5	0.8	0.5	1.1	1.0
	Labour input	1.2	1	0.3	1.2	-0.2
	Total input	-1.3	2.3	2.7	1.2	0.0
	Labour productivity	0.3	-0.2	0.2	-0.1	1.1
	Total productivity	2.8	-1.4	-2.1	0.0	1.0

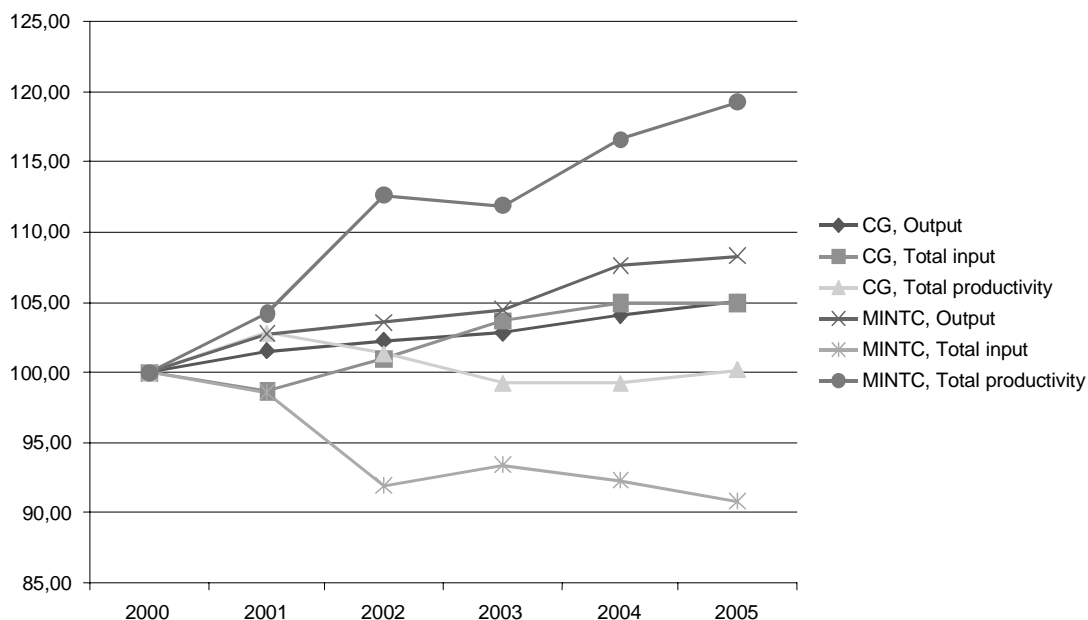
The most striking feature in the case of the Finnish Road Administration (Table 10) is the strong decrease of labour input between 2000 and 2001. In this case it was the result from the establishment a state-owned company, the Finnish Road Enterprise, which is now one of the service providers to the Finnish Road Administration. As we can see from Table 10, there has not been a similar change in the use of total input because the FRA has just consumed less labour input and more services.

Much like with the FRA, the most notable feature regarding the Finnish Maritime Administration is the rapid increase of labour productivity between 2003 and 2004. In this case, too, this is explained by the establishment of a state-owned company, Finstaship. It mainly sells to the FMA icebreaking services that the FMA previously produced itself.

These increases in labour productivity can be seen in Chart 1 which shows the years when the reorganisation took place. It is important to remember that this illustration depicts the central government sector only. Productivity in the whole of the road building and maintenance industry has developed differently, and this is not reported here. It should be borne in mind that according to Finnish national accounts, the volume of the market production output of the civil engineering industry went up by 13.3 per cent in 2001 and by 4.6 per cent in 2004.

**CHART 1: Labour productivity and its components**


The total productivity of the administrative sector of the Ministry of Transport and Communications has increased over the whole reference period, and from 2000 to 2004 the average annual change was around four per cent. The development in the total productivity has been really fast even compared to the market production of the economy. Structural changes in the administrative sector have had a significant impact on the work productivity, causing increases in total productivity, too. An interesting feature in the results is that labour productivity has not increased in the years between the big structural changes.

**CHART 2: Total productivity and its components**


We can see from Chart 2 above that the total productivity of the administrative sector of the Ministry of Transport and Communications has increased notably fast compared to the average overall development in central government. As we can see, the development in output does not deviate as

dramatically from the average. The output volumes of the central government and of the administrative sector have gone up steadily from one year to the next.

The most interesting feature in the total productivity of the MINTC is that it went up dramatically in 2002, one year after the organisational reform. It seems that there was some resistance to adapting to the new forms of production in 2000 to 2001.

### *3. Conclusions and development needs for productivity indicators*

The results presented in this paper verify that it is possible to measure productivity even in collective public services. At the level of a single agency and especially at the level of the administrative sector the established indicators give a reliable picture of how productivity has developed. The time series shows that the indicators take into account structural changes and react to, for example, more effective ways of producing public services. It is possible to measure the productivity of public services and it should be done in the entire central government sector.

It was possible to measure reliably both the productivity of work and total productivity. The critical question in productivity calculations is finding a way of defining the indicators of output clearly. When market prices are not available it is crucial to extend efforts to the defining of the volume of output properly. It is also vital to make a distinction between output and outcome when compiling productivity indicators.

This case study of the administrative sector of the MINTC is not an isolated project in this field. Statistics Finland is currently conducting similar studies in the administrative sectors of the Ministry of Education, Ministry of Finance, Ministry of Agriculture and Forestry and Ministry of Justice. In the near future a project will be launched in the administrative sectors of the Ministry of Trade and Industry, Ministry of the Interior and Ministry of Social Affairs and Health. The aim is that all the administrative sectors (in total 13) will have been separately studied by the end of 2008 so that Statistics Finland will be able to publish individual productivity indicators for all the administrative sectors of central government in spring 2009.

The biggest practical problem was, and is, assigning the right cost to the right public product. All the units have numerous products and accurate book-keeping is essential so that the value, and thereby the weight, can be deduced for each product.

This paper presents quite a different approach to the measurement of collective services. The studied administrative sector alone has approximately 140 different product groups and the data behind the total output index of the statistics on the productivity of the central government cover around 2,000 products and their number is still rising. By comparison, the producer price index compiled by Statistics Finland is based on some 2,300 price observations. Our method tries to solve the problem of quality identification at the micro data level. Atkinson introduced outcome quality corrections at the macro data level (some cases based on micro samples).

One possible way to measure quality changes in collective services is to use (or generate) systems like presented in Highway Capacity Manual (see page 11). This kind of approach could ease the difficulties of summing different quality aspects together.

There is a need for serious discussion about the implementation of outcome corrections in output indicators in national accounts. There has been no clear evidence that summing up public production output with costs instead of prices weakens the comparability of GDP per capita between countries. From the practical viewpoint, the possible outcome-based quality corrections might offer too little and too late for decision makers of general government.

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